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TITLE: System and method for providing dynamic three-dimensional multi-user virtual
spaces in synchrony with hypertext browsing

Abstract Text (1):
A system and method is described for providing shared access to a three dimensional
virtual environment synchronously with hypertext browsing. A cospace server
receives a messages indicating requests for hypertext files on a network from a
client. The cospace server tracks the requests and stores components or the
addresses of components of the requested hypertext files. When a threshold number
of clients have requested a hypertext file, the cospace server constructs a virtual
three dimensional room description and sends it to the clients that are browsing
the file. The virtual three dimensional room description is rendered as a virtual
three dimensional room at the client, and typically includes portals to other
virtual three dimensional rooms. A user is represented in the virtual room as an
avatar, and can communicate with other users at other clients. The present
invention enhances an installed base of conventional hypertext files such as the
World Wide Web with three dimensional and social features without having to carry
out any modifications of the hypertext files where they are stored.

Brief Summary Text (2):
The field of this invention is providing three dimensional (3-D) multi-user virtual
spaces in synchrony with hypertext browsing, and more particularly constructing and
displaying a virtual three dimensional space based upon the determination that a
user is browsing hypertext files at a network site, populating that space with
other users who are visiting the site, using site-to-site transition data to
construct portals between virtual three dimensional rooms comprising the space, and
using avatar movement between three dimensional rooms to drive client software that
displays the space to the user.

Brief Summary Text (3):
A known method for presenting information to users connected to a network uses
hypertext techniques wherein the presented information includes user-selectable
areas, called "links", which function as gateways to further information. An
example of a system that provides hypertext information to users is the World Wide
Web (WWW) on the Internet. The WWW is a collection of websites. Each website
includes a collection of hypertext files, often pertaining to a single theme.
Website files are stored on a computer on the Internet called a web server, which
is a server connected to the Internet and having an Internet Protocol (IP) address.
A user connects to the Internet through a computer and executes software called a
browser. The browser sends the user's request for hypertext information to a
website, and receives, consolidates, and displays the requested hypertext
information to the user.

Brief Summary Text (6):
An example of a known WWW browsing system is shown in FIG. 1. Clients A 101, B 102
and C 103 each execute browsers (not shown) and are connected to a network 104,
which in this case is the Internet. Web server computers A 105 and B 106 are also
connected to the Internet 104. A request for a hypertext file is sent from client A
101 to web server B 106. Web server B sends the file to client A, where it is

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displayed as a two-dimensional page to the user 107.

Brief Summary Text (8):
Other known systems present virtual reality environments to users through a
network. A virtual reality (VR) environment is a computer-displayed three-
dimensional environment with which a user is able to interact (e.g., "move"
through, "kick" a virtual 3-D ball) using input and output devices at the user's
computer. Known VR systems include VR browsing software that is executed on the
user's computer. VR browsing software can be a stand-alone program, as in the VR
browser made by the Oz Virtual Company of Iceland. Alternatively, VR browsing
software can be software that executes in association with other software, such as
the Cosmo Player by SGI, Incorporated which runs within the Netscape Navigator
hypertext browser made by the Netscape Communications Company of California as a
series of plug-ins, using Java as its user interface. The VR browser sends the
user's request for VR data to a computer on a network (e.g., a VR server on the
Internet) to send a VR file. A VR file describes a 3-D scene or environment. When
the browser receives the VR file, it displays (renders) the described 3-D scene on
the client computer. An example of a VR file is one that is written in Virtual
Reality Modeling Language (VRML).

Brief Summary Text (9):
An example of a VR system is shown in FIG. 2. Clients A 201, B 202 and C 203 are
connected to network 204. VR servers A 205 and B 206 that store the layouts of VR
environments are also connected to network 204. Client A 201 executes a VR browser
(not shown) through which it sends a request to VR server B 206. VR server B 206
responds by sending VR data to client A 201, which is displayed to the user 207.
User 207 provides input to client A 201 by which the user "moves" through the VR
environment scene whose description is stored on server B 206. These inputs are
interpreted by the browser on client A 201 to change the view of the VR scene whose
description was obtained from VR server B to the user 207. When the user's input
necessitates obtaining further VR description data from server B 206, the browser
on client A 201 sends a request to server B 206 for the needed information. Server
B 206 responds by sending the data to client A 201.

Brief Summary Text (10):
The system shown in FIG. 2 allows the presentation of 3-D information to the user
and allows the user to interact with the information by navigation, as if the user
was "in" the environment. This enables a new and complementary set of user
experiences over the network to that of conventional browsing.

Brief Summary Text (12):
Certain known systems support social interaction among users viewing the same VR
environment. In the system shown in FIG. 3, clients A 301, B 302 and C 303 browse a
VR environment whose description is stored on VR server 304 through network 305.
Clients A 301, B 302 and C 303 send requests to server 304 for VR descriptive data,
which is sent by server 304 to clients A 301, B 302 and C 303, where various views
of the VR environment are displayed to users 306, 307 and 308. Each client executes
multi-user software that is designed to interact with multi-user server 309. This
software is a part of the VR browser executed by each client, or else is a separate
program that executes in tandem with the VR browser.

Brief Summary Text (19):
The present invention includes a cospace server connected to a network that tracks
the hypertext files browsed by a set of users. When a user, through a client,
requests a hypertext file from a site over a network, that request is captured and
recorded by a computer connected to the network. In one embodiment of the present
invention, this request is captured by a proxy server and forwarded to the cospace
server. In another embodiment, the request is sent directly from the client to the
cospace server. The captured request is tracked by the cospace server, and includes
the identity of the user requesting the file and the identity of the requested file

to the cospace server. In one embodiment, the cospace server tracks user activity
for each hypertext file. In another embodiment, the cospace server tracks usage for
a group of hypertext files. When a usage threshold (e.g., a minimum number of
browsing users) or other criteria is reached for the tracked file, the cospace
server generates a 3-D VR room description. In one embodiment, the room description
corresponding to the file. In another embodiment, the room description is created
independently from the file, and derives no components from the file. In this
embodiment, the room description is comprised of features stored in a database
connected to the cospace server. In yet another embodiment, the room description is
comprised of some features from the corresponding file, and some features stored
independently on the database connected to the cospace server. Once activity
tracked at a site meets predetermined criteria and the room description is
constructed, the room description is sent from the cospace server to clients to be
displayed as a three dimensional virtual room.

Brief Summary Text (23):
The VR environment can include 3-D features that represent salient features of the
file upon which it is based, including hypertext links, graphics, etc. The VR
environment may be custom decorated by users, and may include portals to other VR
environments on the network.

Detailed Description Text (2):
An embodiment of a system in accordance with the present invention is shown in FIG.
4. Clients A 401, B 402 and C 403 are connected to a network 404. Examples of
network 404 include the Internet; an Intranet; a Local Area Network (LAN); and a
Wide Area Network (WAN). In the embodiment shown in FIG. 4, network 404 is the
Internet. A client is a computer comprising a processor; memory; a port to be
connected to an input device; a port to be connected to an output device; a port to
be connected to a network; an electronic data bus connecting the processor, memory,
and ports; an input device connected to the input port; and an output device
connected to the output port. Examples of input devices include a keyboard; a
mouse; a joystick; a camera; and a microphone. Examples of output devices include a
video monitor; a printer; and a speaker. In another embodiment, the network 404 is
an Intranet.

Detailed Description Text (3):
Also connected to the network 404 are sites A 405, B 406 and C 407. A site is a
server that stores at least one hypertext file and the software necessary to
service network requests directed to that site (i.e., web server software). A site
server comprises a processor; computer readable memory; a port to be connected to a
network; and an electronic data bus that connects the processor, memory and port.
In the embodiment shown in FIG. 4, sites A 405, B 406 and C 407 are websites on the
WWW.

Detailed Description Text (4):
In accordance with the present invention, client A 401 sends a request to obtain a
hypertext file at site B 406. In the one embodiment of the present invention, this
request is sent to a proxy server 408 connected to network 404. In another
embodiment, it is sent directly from the client A 401 to site B 406 through network
404.

Detailed Description Text (5):
In the embodiment where the hypertext file request is received by proxy server 408
from client A 401, proxy server 408 then sends a request to site B 406 to send the
requested file to the proxy server 408, through which the file is sent to the
requesting client A 401. The proxy server 408 also keeps track of components of the
hypertext file, including a list of graphics sent from site B 406 in response to
client A's 401 request forwarded by proxy server 408. The proxy server 408 sends a
message to a cospace server 409, also connected to network 404, indicating the
identity of the requesting client, client A 401, and a location identifier of the

hypertext file requested by the client. In one embodiment of the present invention, the location identifier is the Uniform Resource Locator (URL) of the requested file. In another embodiment of the present invention, software integrated with the user's browser running on client A 401 keeps track of requested file components and sends client and file identification data to the cospace server 409.

Detailed Description Text (7):
In accordance with the present invention, the cospace server comprises a processor; computer readable memory; a port to be connected to a network; a port to be connected to a database; and an electronic data bus that connects the processor, memory and ports, as well as computer readable instructions (called cospace server software) stored in computer readable memory. The cospace server software is executed by the processor to configure the cospace server into a receiver, a virtual three dimensional room builder, and a sender.

Detailed Description Text (8):
In accordance with the present invention, the receiver receives a message sent from a client over the network. In one embodiment, the receiver comprises the port connected to the network, the data bus, the processor and computer readable memory with instructions. These are configured to cooperate in accordance with message receiving instructions stored in the computer readable memory. The port connected to the network initially receives and conveys the message to the electronic data bus, over which the message is conveyed to the processor. The processor receives the message using receiving instructions (included in cospace server software), which are stored in the computer readable memory and retrieved by the processor over the data bus and executed.

Detailed Description Text (10):
The sender is comprised of the processor, data bus, computer readable memory with instructions, and port connected to the network, configured to cooperate in accordance with sending instructions stored in the computer readable memory. The processor sends a three dimensional room description to a client by retrieving over the data bus certain sending instructions which are stored in the computer readable memory.

Detailed Description Text (17):
When a 3-D VR environment is displayed, each user appears as an avatar to other users in the environment. This functionality is supported by using a multi-user server 411 as is known in the art to generate, track, and exchange avatar and communications data between users occupying the same VR environment. In accordance with the present invention, user 410 selects an avatar by communicating through client A 401 with multi-user server 411 connected to the network 404. In one embodiment, the user selects an avatar from a set of predetermined avatars. In another embodiment, an avatar is randomly assigned to the user. In yet another embodiment, the user can build her own avatar using an avatar editing tool that enables the user to specify avatar characteristics such as torso length, body type, head shape, and facial characteristics.

Detailed Description Text (31):
In another advantageous feature of the present invention, a user 410 can indicate through the cospace client software running on client 401 the elements of decoration she would like used to decorate the 3-D VR room currently displayed on her client. Such elements might include custom wallpaper, objects, images of her or her pets, or text messages she desires displayed on the wall of the room. In the current invention, these indications are sent as a message from the client 401 to the cospace server 409, which uses them to decorate the current room. The cospace server can allow multiple users to added decorative items to the room or, alternatively, allow only one user or a group of users to decorate a room.

Detailed Description Text (32):

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The present invention is not limited to the embodiment shown in FIG. 4. In the embodiment shown in FIG. 5, three cospace servers 501, 502 and 503 are connected to network 504. Two multi-user servers 505 and 506 and two proxy servers 507 and 508 are also connected to the network. These serve clients 509, 510 and 511 accessing websites 512, 513 and 514. In one embodiment, proxy servers 508 and 509 partition the load among cospace servers 501, 502 and 503 with databases 515, 516 and 517, respectively. In one embodiment, the load among multi-user servers 505 and 506 is partitioned along the same lines as the load partitioned among the cospace servers 501, 502 and 503. For example, a cospace server 501 sends the address of a multi-user server with which a client 509 is to communicate (for avatars and communications with other users) along with the VR environment data sent to the client. This embodiment shows that the present invention is advantageously scalable and able to serve large numbers of users.

CLAIMS:

10. The method of claim 1, wherein the room description includes the network address of a multi-user server for tracking and rendering the movements of avatars in a virtual room, and for relaying communications between clients.

17. The method of claim 16, wherein the room description includes the network address of a multi-user server for tracking and rendering the movements of avatars of the group leader and the group followers, and for relaying communications between the members of the group.

21. An apparatus for providing clients connected to a network shared access to a three dimensional virtual environment synchronously with hypertext browsing, comprising:

a. a receiver that receives a message sent from a client;

b. a virtual three dimensional room builder that constructs a three dimensional virtual room based upon a hypertext file requested by a client in a message, wherein the description of the virtual three dimensional room comprises portal data that is rendered at the client to a user as a doorway from a first virtual three dimensional room to a second virtual three dimensional room; and

c. a sender that sends the virtual three dimensional room description to a client that requested a hypertext file.

23. A system for providing clients connected on a network shared access to a three dimensional virtual environment synchronously with hypertext browsing, comprising:

a. means for receiving a message indicating a request from a client for a hypertext file;

b. means for constructing a virtual three dimensional room description based upon the requested hypertext file, wherein the virtual three dimensional room description comprises portal data that is rendered at the client to a user as a doorway from a first virtual three dimensional room to a second virtual three dimensional room; and

c. means for sending the virtual three dimensional room description to the requesting client.

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